

THURSDAY, DECEMBER 10, 1908.

**BIOLOGICAL RESEARCH ON THE LANCA-  
SHIRE COAST.**

*Report for 1907 on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool and the Sea-Fish Hatchery at Piel. Drawn up by Prof. W. A. Herdman, F.R.S., assisted by Mr. Andrew Scott and Mr. James Johnstone. No. xvi. Pp. 406; with illustrations. (Liverpool, 1908.)*

ABOUT half the bulk of this report is devoted to a monograph on the edible crab by Mr. Joseph Pearson. Excellent features of this work, which is illustrated with twelve plates and numerous diagrams in the text, are the methodical arrangement of the matter and the clearness and simplification of the descriptions. Hitherto, students who aspired to more than a general knowledge of the anatomy and development of the crab have had to search out and abstract for themselves the numerous original memoirs scattered in various scientific journals in different languages, a labour which only specialists care to undertake. It is, therefore, extremely useful to have all these researches carefully epitomised and brought together in one volume. Again, although the general features of the anatomy and development are fairly well known to readers of text-books, the average student knows very little about the habits of the crab, partly because the literature of this part of the subject is mainly of recent growth, and partly because the original memoirs dealing with it are contained in reports which have a somewhat limited circulation. Accordingly, much of the information contained in the section of this work which deals with "Bionomics," namely, such matters as the migrations, spawning habits, rate of growth, age and size at maturity, frequency of casting, "autotomy" and limb-regeneration, &c., will be new to those readers who have not consulted the more recent annual reports of the Fishery Board for Scotland and other journals. Altogether, Mr. Pearson's monograph maintains the high standard of excellence characteristic of the series of "L.M.B.C. memoirs" of which it is the latest number. This series of monographs can only be described as a boon both to general students and specialists.

A voluminous and important contribution to this report is given by Prof. Herdman, assisted by Mr. Andrew Scott, under the title of "An Intensive Study of the Plankton around the South End of the Isle of Man." The thorough nature of this investigation may be gathered when it is stated that the numbers of every species of organism obtained in more than 800 separate gatherings of plankton were carefully estimated—a vast labour in itself. More than 600 of these samples were collected within a very restricted area in the neighbourhood of Port Erin, simultaneous hauls being made with various kinds of pelagic nets both of the horizontal (tow-net) and vertical type, and these were worked in different depths of water. These samples were collected every week and almost every day during a full yearly period.

One feels justified in accepting with confidence conclusions which are based on observations the frequency of which in time and space is so great. On this secure basis Prof. Herdman discusses the seasonal changes in the abundance of plankton as a whole and of its various constituents, and arrives at important general conclusions regarding its vertical and horizontal distribution. Thus, it has been found, here as elsewhere, that diatoms reach their maximum development in April, and rise again to a second but less important and less constant maximum in autumn; dinoflagellates rise to a maximum later than the diatoms, and have also a sudden periodic increase in autumn; copepods attain their maximum in early summer after the diatoms have died down, and again in late autumn they follow the phytoplankton. The distribution of particular species is also exhaustively discussed and illustrated by means of frequency curves. Of more general interest is the evidence that the zone of most abundant life is not at the surface, but is generally a few fathoms below. This observation is of decided importance in connection with the depth at which certain plankton-feeding fishes such as the mackerel and herring swim. As regards the horizontal distribution, it is found that while some organisms have a very regular and uniform distribution over a considerable area, others are distributed very unevenly, including those which markedly tend to congregate in shoals.

"The horizontal distribution is consequently liable to be very variable and irregular, and although its characteristic constitution at different times of the year may be described, it is very doubtful whether any numerical estimate can be framed which will be applicable to wide areas."

This conclusion appears rather to discount the efforts of certain German naturalists to arrive at a census of pelagic organisms in whole seas on the basis of the numbers caught in hauls with specially designed quantitative apparatus.

Considerable light on the movements of plaice, and on the intensity with which the fishing for this species is carried on on the Lancashire and Welsh coasts, is thrown by the results of marking experiments reported on by Mr. James Johnstone and illustrated by means of two charts. These experiments bring to light a marked tendency on the part of small plaice to leave the estuaries and bays of this coast and move seawards in the summer months. The older fishes apparently leave the district for good. Some of these were found to have crossed the Irish Sea, while others had entered the Firth of Clyde. From 25 to 30 per cent. of the fishes liberated were returned by fishermen, but Mr. Johnstone has good reasons for believing that many more are re-captured than are returned. This represents a considerable intensity of fishing in the eastern part of the Irish Sea, and it is further interesting to note that by far the greatest numbers of marked plaice were re-caught by first-class sailing trawlers. There is still, however, a good deal of obscurity as to the exact direction of the movements of the plaice in this district

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at different stages of their lives. Further experiments with much larger batches of fishes will be required in order to provide material for the construction of a complete and convincing picture of these movements. In future experiments it would be desirable to determine the sex and maturity as well as the size of the fishes liberated, in order to discover whether there is any difference in the migrations of the two sexes, and to distinguish spawning migrations from feeding migrations.

From time to time, over a period of fifteen years, but, unfortunately, not with any regularity, experimental hauls have been made by the Lancashire authorities with shrimp-net, shank-net, and fish-trawl both on the Blackpool closed ground and in the Mersey estuary. The numbers of flat fishes and shrimps caught in these hauls form the basis of two short but valuable papers by Mr. Buchanan-Wollaston. The method adopted in this research is that of reducing the catches to the average number caught per hour in different months, quarters, and years, and then expressing the results in the form of frequency curves. The curves for the monthly data were too irregular to show any general tendency, but by taking the averages for certain combinations of months and for different years, and "smoothing" the curves thus produced, certain interesting features are brought to light. Thus it is clearly seen that on the Blackpool closed ground there has been a steady falling off in the catch per hour of plaice since 1892. No explanation is offered of this remarkable phenomenon, which, one supposes, must be due to the increased intensity of fishing on the offshore grounds. It is also shown that the "shank-net" is "superior to the shrimp-trawl in avoiding the capture of young fish, and this with no loss or even a small gain in the capture of shrimps."

In the Mersey estuary, plaice and soles reach their maximum abundance in late summer and autumn, but it is doubtful whether the data are sufficiently complete to justify the conclusion that soles attain their maximum in August and plaice in September. Finally, an examination of the (smoothed) curves showing the average catch per hour of plaice and soles on the Mersey banks shows some remarkable fluctuations, those of the two species being complementary, so that in those years when plaice were least abundant, soles attained their maximum. The importance of such researches as these from the point of view of the local fisheries scarcely requires to be emphasised.

In addition to these papers, Dr. H. Bassett contributes one on hydrographic observations, and Mr. Johnstone one on fish parasites.

As regards the work of the Piel hatchery, while it is questionable whether any demonstrably useful purpose is being served by annually "dumping" in the Irish Sea millions of newly-hatched fry of plaice and flounder, it seems not improbable that the holding of classes for fishermen is as effective in practice as it is excellent in theory.

It will thus be seen that the work which these two institutions are vigorously carrying on in the interests of marine biology in general, and the local

fisheries in particular, is of a comprehensive and many-sided character. The expenses of this work appear to be met by funds derived from several distinct sources. For example, the cost of holding classes for fishermen at Piel is defrayed by a grant from the education committee of the Lancashire County Council, while Mr. Pearson's work on the crab was done and published, we are told, under the auspices of the Lancashire Sea Fisheries Committee, with the aid of grants from the Board of Agriculture and Fisheries, the University of Liverpool, and the Liverpool Marine Biology Committee. This appears to be a somewhat complicated arrangement, which perhaps, however, has the advantage of the safety which is popularly supposed to reside in numbers. It shows, at any rate, that marine biology in Lancashire does not lack friends.

W. W.

#### LABORATORY ARTS.

*Laboratory Arts.* A Teacher's Handbook dealing with Materials and Tools used in the Construction, Adjustment, and Repair of Scientific Instruments. By Dr. George H. Woollatt. Pp. xii+192; with 110 diagrams. (London: Longmans, Green and Co., 1908.) Price 3s. 6d. net.

SKILL and wide knowledge in "laboratory arts" are much rarer attainments than the accumulation of ideas relating to abstract or even to mathematical physics, yet, without making comparisons, it is essential to the success of the experimentalist. If it were not for the fact that such skill and knowledge are not to be acquired by mere reading of a few books, it might be thought that the disproportion alluded to above might be the result of the still more marked disproportion between books of the text-book type dealing with the two branches of attainment. Actually, it is probably the cause, or partly so, and it may be also that the scarcity of books such as that now being noticed is due to a belief on the part of the few qualified to write them that, dealing as they do with a subject which directly is not an examination subject, there will be no great demand for them. Whatever the cause may be of the scarcity of books dealing with laboratory arts, they are actually invaluable, and from Faraday's chemical manipulation onwards they furnish the experimentalist with ideas as to how to accomplish his purpose.

Dealing as such books must do with all the properties of all materials and with the means peculiar to each whereby they may best be cut, distorted, attached, or protected, it is not possible for any one writer to be equally strong in all parts. A writer is certain to be specially strong in certain departments; let it be so; those who are or might be his fellow-writers of similar books will be quick to recognise these parts, and to benefit by them. Conversely, of course, no one book is likely to be quite satisfactory in dealing with every kind of operation where they are so diverse. Leaving now generalities and coming to the "Laboratory Arts" as presented by Mr. Woollatt, we find an admirable choice of material admirably presented. It must be understood that the teacher or the experimentalist probably is not and may not